CarpatClim project: the database and procedures for drought indices

Compiled by:

Pavol Nejedlik, SHMI, Slovakia

Integrated Drought Management Programme in Central and Eastern Europe, Bratislava 5-6 October 2012

Objective of CarpatClim

To improve the basis of climate data in the Carpathian Region for applied regional climatological studies, including the development of a Climate Atlas and of indicators for drought monitoring

Outputs:

-digital climate atlas of the region

-daily meteorological data in 0.1°resolution from 1961 to 2010

Start: Dec. 2010
Duration: 36 months

/24 months for preparing + 12 months to host the website/

Participating countries:

Country	Invest. area [km^2]	%
Austria	0	0
Croatia	14 662,66	3,0
Czech Republic	12 570,58	2,6
Hungary	86 996,47	18,0
Poland	19 794,32	4,1
Romania	184 434,63	38,1
Serbia	45 015,09	9,3
Slovakia	48 520,49	10,0
Ukraine	71 530,71	14,8
sum	483524,9463	100,0

Project Structure

*Module 1:

Improve the availability and accessibility of a homogeneous and spatially representative time series /data rescue, quality control, and data homogenization/

*Module 2:

Ensure data harmonization with special emphasis on harmonization across country borders and

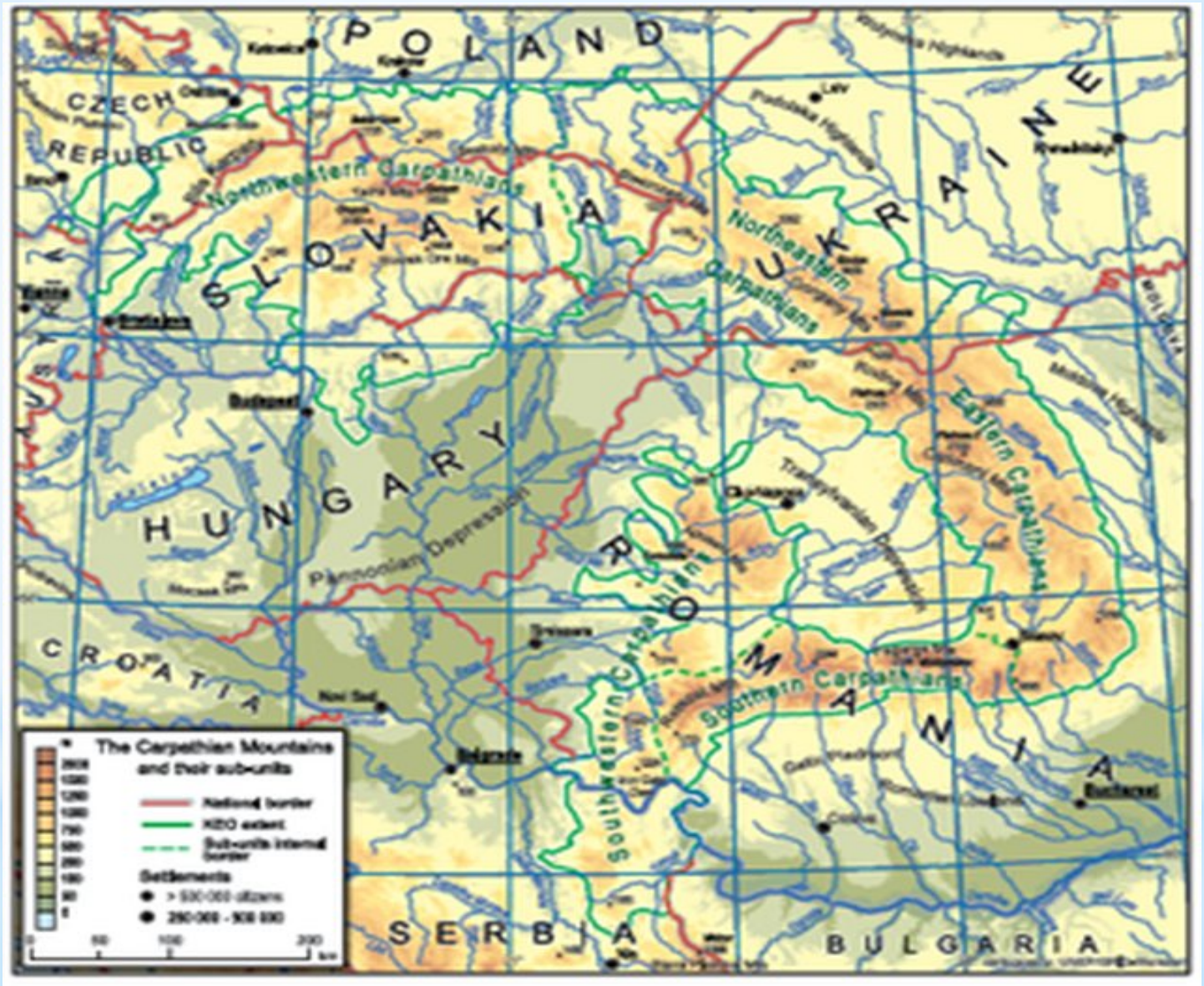
production of gridded climatologies per country.

*Module 3:

-To develop a Climate Atlas as a basis for climate assessment

-To calculate drought indicators as a contribution to European Drought Observatory /**http://edo.jrc.ec.europa.eu/**

CarpatClim territory



Integrated
Central and Eastern Europe, Bratislava 5-6
October 2012

50°N and 44°N, 17°E and 27°E

Set of meteorological variables in daily temporal resolution to be provided

Average temperature	Cloud cover
Minimum temperature	Global radiation
Maximum temperature	Relative humidity
Precipitation	Wapour pressure
Wind direction	Air pressure
Wind speed	Snow depth
Sunshine duration	

The density of the meteorological stations in the area:
Precipitation -1 station per 25x25 km /578 stations/
Temperature – 1 station per 50x50 km /195 stations/

Climatological outputs

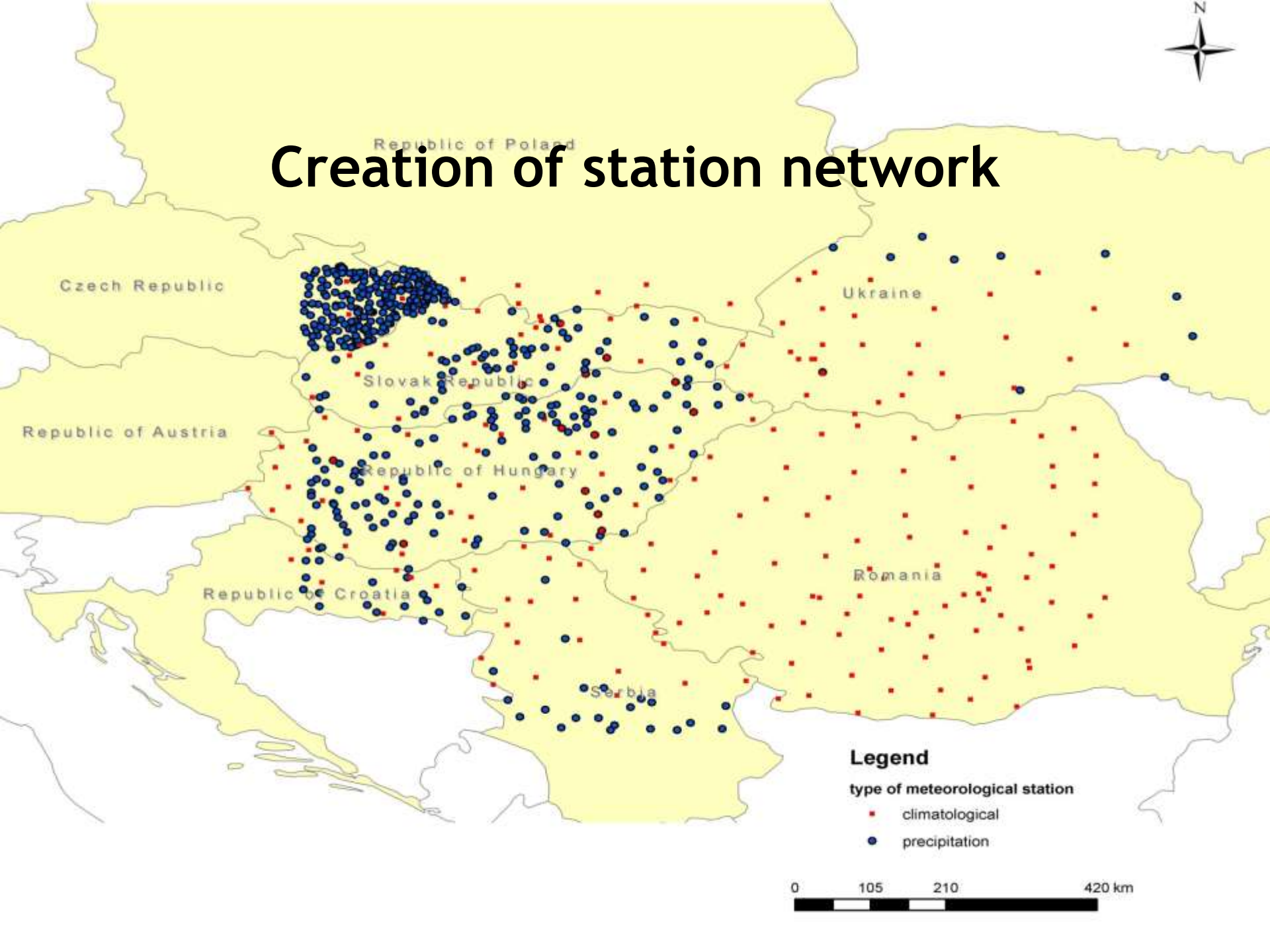
- interpolation of daily data onto a regular grid covering the entire area
- calculation of monthly, yearly, and long-term statistics
- analysis of extreme values (minima, maxima, frequencies, etc.)
- calculation of indicators (e.g., frequency, intensity, duration) for meteorological events such as droughts, frosts, hail, extreme rainfall, and snow cover.

Some variables and indicators to be provided for the Digital Climate Atlas of the Carpathian Region

Drought Indices

* PAI (PaDI)
* SPI
* Reconnaissance Drought Index
* Palmer Drought Severity Index
* Aridity index
* Moisture index
* Percentage of extremely hot days
* Growing season length
* Percentage of wet days, wet days above 20 mm/days
* Greatest 1-day and 5-day total rainfall

Creation of station network

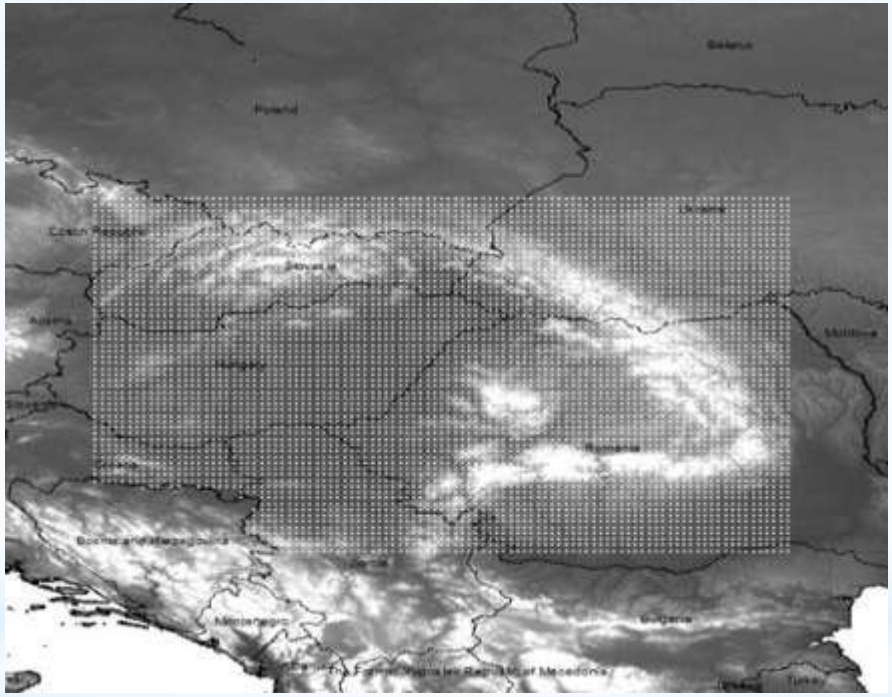


Calculating selected drought indices

/Derived from SpinoniJ. et al : Comparing four drought indicators in the Carpathian Region on a 0.1˚x0.1˚ regular grid for 1961-2010 /

Input variables

Daily gridded
0,25˚x0,25˚
T, RR



Outputs

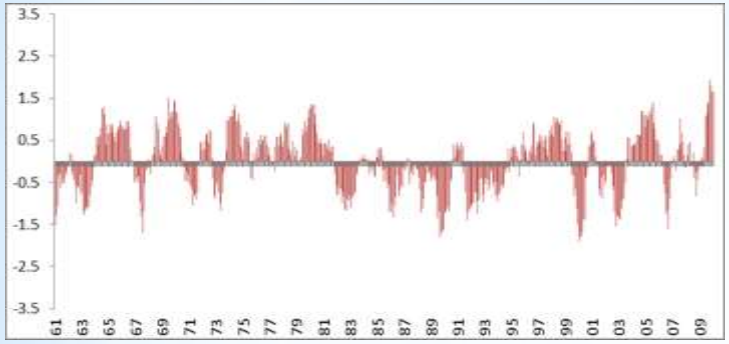
SPI, SPEI, RDI
(3,6,12)

PADI (12)

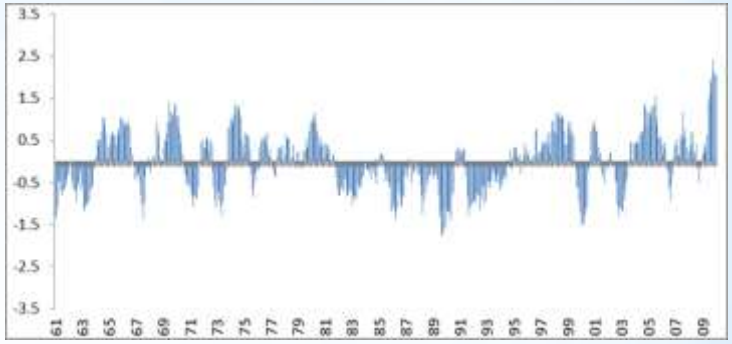
Contact: Spinoni Jonathan, Ph.D, European Commission • Joint Research Centre Institute for Environment and Sustainability Climate Risk Management • DESERT Action
Tel. +39 0322 785868, Email: jonathan.spinoni@jrc.ec.europa.eu

1961-2010 DROUGHT SECULAR RECORDS

RDI 12



SPEI 12



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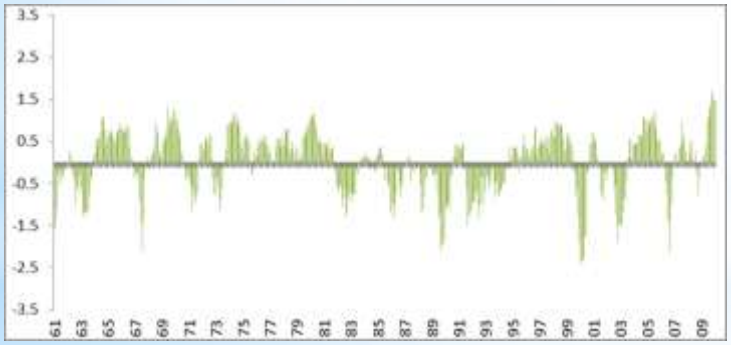
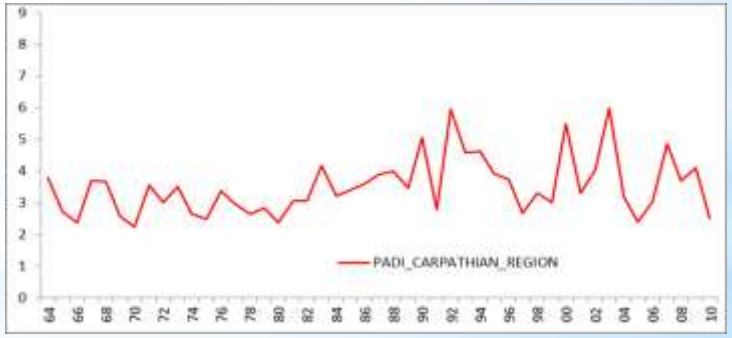


PADI 12



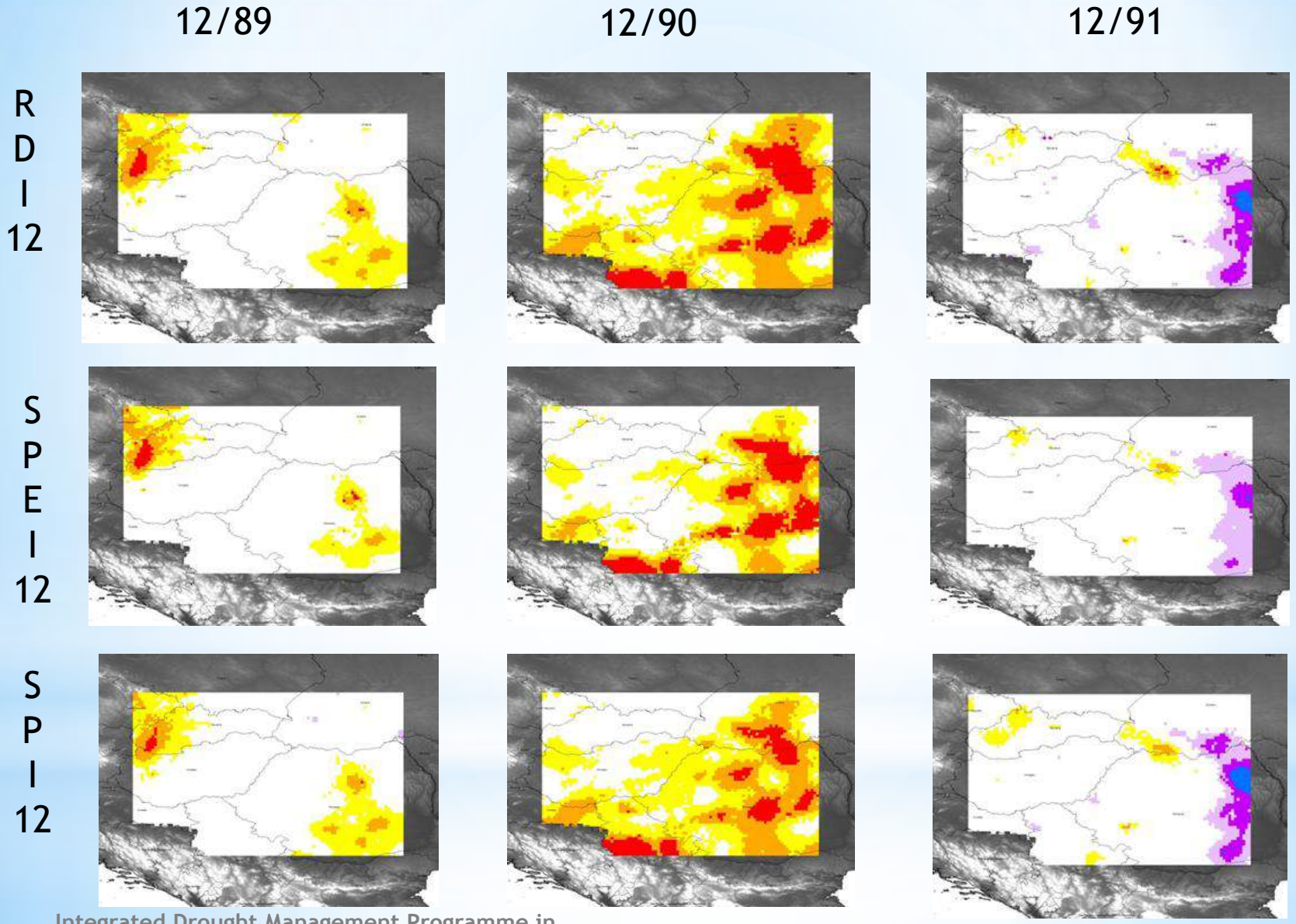
Values of the indices

SPI

SPEI

RDI

SPI value	Class	CDF	Probab (%)
SPI > 2.0	Extreme Wet	0.977–1.000	2.3
1.5 < SPI ≤ 2.0	Severe Wet	0.933 – 0.977	4.4
1.0 ≤ SPI ≤ 1.5	Moderate Wet	0.841 – 0.933	9.2
-1.0 < SPI < 1.0	Normal Climate	0.159 – 0.841	68.2
-1.0 ≤ SPI ≤ -1.5	Moderate Dry	0.067 – 0.159	9.2
-2.0 ≤ SPI < -1.5	Severe Dry	0.023 – 0.067	4.4
SPI < -2.0	Extreme Dry	0.000 – 0.023	2.3


12/89
12/90
12/91
RDI 12
SPEI 12
SPI 12

Correlations in between the indices

Correlation	3	6	12
RDIvSPEI	0,904	0,973	0,989
SPEIvSPI	0,948	0,955	0,952
SPIvRDI	0,821	0,911	0,964

Findings/conclusions

- RDI, SPEI, SPI are highly correlated, especially SPI-3 with SPEI-3, and SPEI-6 with RDI-6;

- RDI, SPEI, SPI detect drought conditions with similar spatial and temporal structures in case studies and in long term mean records;

- Precipitation is more important than PET in SPEI and RDI, that's why SPI, SPEI, and RDI are very similar if drought is caused by a rainfall deficit;

- SPEI is the best one to study heat waves and it is preferable to RDI. SPEI may be considered the best one if climate change is occurring (e.g. temperature increasing);

- If drought is caused by rainfall deficit, SPI proved to perform as the best indicator;

- RDI is based on a ratio: it is more extreme than SPEI and SPI; RDI should not be used in regions with extreme low precipitation regimes;

- In general, a few adjustments must be done for RDI and SPEI in extreme climates;

Further developement

-Grided data will be freely available based on the registration
-To enlarge the grided area
-ClimCar is the only project in Europe which shares the data/outputs for free
-Further to the data share various applications /in agriculture, hydrology and other sectors are available
-ClimCar forms a good platform for its use in different sectors
-A book and some more publications in journals are expected